MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

BEM3014 –ECONOMETRICS MODELLING

(All sections / Groups)

2 MARCH 2016
9 a.m. - 11 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of SIX pages with FOUR questions only excluding cover page.
2. Attempt **ALL** questions. The distribution of the marks for each question is given.
3. Write all your answers in the answer booklet provided.
4. Formulas and statistical tables are attached.

QUESTION 1

(a) Based on a sample of 50 respondents, the following regression is obtained:

$$\ln\frac{P_i}{1-P_i} = -9.456 + 0.3638 income_i - 1.107 Sex_i$$

z-stat =	(3.60415)	(- 4.3669)
P-value =	[0.0025]	[0.0002]

where P = the odds of smoking,
1 for smokers
0 for non-smokers
Income = the income in thousands of Ringgit.
Sex = 1 for females
0 for males

Out of the 50 respondents, 31 are smokers, 16 are females, and the income ranged from a minimum of RM18,000 to a maximum of RM44,000.

(i) Interpret the preceding logit regression. (6 marks)

(ii) Which of the coefficients are individually statistically significant at α = 5%? (5 marks)

(iii) Compute the logit value of a female smoker with an income of RM44,000. (4 marks)

(iv) For the same respondent as in part (iii), compute the probability of smoking. (5 marks)

(b) Discuss any TWO (2) inherent limitations that make the Linear Probability Model (LPM) not the preferred choice for modelling dichotomous variables. (6 marks)

(c) Show that the logistic function, $D = \frac{1}{(1+e^{-Z})}$, is equivalent to the logit model, $Z = \ln\left[\frac{D}{1-D}\right]$, where $Z = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + u$. (6 marks)

(Total: 32 marks)

Continued...

QUESTION 2

In order to study the financial development in Malaysia, quarterly data that cover the period from 1997 Q1 to 2009 Q4, a total of 52 observations are collected. All the variables of financial development (FD), foreign direct investment (FDI), Real GDP per capita (RGDPC) and Capital (K) are in logarithm forms.

(a) The Dickey-Fuller tests with a constant and a trend are shown below.

$$\Delta \hat{LRGDPC}_t = -0.020 LRGDPC_{t-1} + 0.153 + 0.005t$$
$$\tau \quad = (-0.679) \qquad (0.750)\ (0.006)$$

$$\Delta \hat{LFD}_t = -0.011 LFD_{t-1} + 0.059 + 0.007t$$
$$\tau \quad = (-0.489) \qquad (0.379)\ (0.000)$$

What are the null and alternative hypotheses for the above unit root test?
At $\alpha = 5\%$, what do you conclude? (8 marks)

(b) Given that changes in the variables, DLRGDPC = LRGDPC – LRGDPC(-1) and DLFD = LFD – LFD(-1).

The Dickey-Fuller tests with a constant are shown below.

$$\Delta \hat{DLRGDPC}_t = -0.827 DLRGDPC_{t-1} + 0.012$$
$$\tau \quad = (-5.789) \qquad (1.585)$$

$$\Delta \hat{DLFD}_t = -0.983 DLFD_{t-1} + 0.017$$
$$\tau \quad = (-6.801) \qquad (2.234)$$

What are the null and alternative hypotheses for the above unit root test?
At $\alpha = 5\%$, what do you conclude? (8 marks)

Continued...

(c) What does the Johansen Cointegration Test indicate in Table 2a below? (5 marks)

Table 2a: Johansen and Juselius Cointegration Test

Date: 12/11/15 Time: 00:35
Sample (adjusted): 1998Q1 2009Q4
Included observations: 48 after adjustments
Trend assumption: Linear deterministic trend
Series: LFD LRGDPC LFDI LK
Lags interval (in first differences): 1 to 3

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.449454	50.94087	47.85613	0.0214
At most 1	0.249623	20.29234	29.79707	0.3297
At most 2	0.144238	8.507719	15.49471	0.5294
At most 3	0.000648	0.231120	3.841466	0.8689

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.449454	29.64853	27.58434	0.0254
At most 1	0.249623	18.78462	21.13162	0.3830
At most 2	0.144238	8.476599	14.26460	0.4344
At most 3	0.000648	0.131120	3.841466	0.8699

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

(d) Referring to the Table 2b of partial Vector Error Correction Estimates below,

(i) Write down the long-run equation and interpret accordingly. (6 marks)

(ii) Interpret the meaning of ECT (error correction term) of -0.730. (3 marks)

Table 2b: Partial Vector Error Correction Estimates

Vector Error Correction Estimates
Date: 13/11/15 Time: 09:48
Sample (adjusted): 1998Q1 2009Q4
Included observations: 48 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Continued...

Cointegrating Eq:	CointEq1
LFD(-1)	1.000000
LRGDPC(-1)	-1.261790 (0.02518) [-50.1059]
LFDI(-1)	-0.160745 (0.02649) [-6.06775]
LK(-1)	0.212715 (0.12685) [1.67693]
C	2.748061

Error Correction:	D(LFD)	D(LRGDPC)	D(LFDI)	D(LK)
CointEq1	-0.730292 (0.24019) [-3.04049]	0.242025 (0.22251) [1.08770]	0.129433 (0.42441) [0.30497]	-0.044727 (0.12245) [-0.36527]

(e) Referring to the Table 2c of short-run Granger causality test, interpret the result. (6 marks)

Table 2c: Short-Run Granger Causality Test

VEC Granger Causality/Block Exogeneity Wald Tests
Date: 13/11/15 Time: 17:54
Sample: 1997Q1 2009Q4
Included observations: 52

Dependent variable: D(LFD)

Excluded	Chi-sq	df	Prob.
D(LFDI)	30.22932	12	0.0026
D(LRGDPC)	14.72288	12	0.2569
D(LK)	21.50639	12	0.0434
All	67.21100	36	0.0012

Dependent variable: D(LFDI)

Excluded	Chi-sq	df	Prob.
D(LFD)	23.98443	12	0.0204
D(LRGDPC)	23.39792	12	0.0245
D(LK)	23.92561	12	0.0208
All	63.26058	36	0.0033

Dependent variable: D(LRGDPC)

Excluded	Chi-sq	df	Prob.
D(LFD)	15.82326	12	0.1995
D(LFDI)	12.32216	12	0.4202
D(LK)	13.98317	12	0.3018
All	36.82666	36	0.4305

Dependent variable: D(LK)

Excluded	Chi-sq	df	Prob.
D(LFD)	17.93616	12	0.1176
D(LFDI)	16.41443	12	0.1730
D(LRGDPC)	10.79759	12	0.5463
All	48.57377	36	0.0786

(Total: 36 marks)

QUESTION 3

(a) "Panel data can enrich empirical analysis in ways that may not be possible if we use only cross-section or time series data."

Based on the above statement, what are the advantages of panel data over cross-section or time series data? (10 marks)

(b) A study was carried out to examine whether money supply (X) affects GDP growth (Y) in Singapore, Malaysia and Thailand. Annual data from year 1994 to 2013 were collected for estimation.

The observations from three countries for the abovementioned period were pooled to run the pooled regression and its results are as follows:

$\hat{Y}_{it} = 24.685 - 0.145X_{it}$ $\quad R^2 = 0.2687$

$t \quad = (6.684) \quad (-4.63)$ $\quad d = 0.6911$

Instead of pooled regression, a Fixed Effects Model (FEM) was estimated to investigate the relationship between money supply and GDP growth in the three countries for the same period as above. The results are shown as below:

Continued...

$$\hat{Y}_{it} = 16.456 - 0.198X_{it} + 3.422DS + 1.806DM \qquad R^2 = 0.7195$$
$$t = (7.589)\ (-5.265)\ \ (8.721)\ \ (4.564) \qquad d = 1.871$$

where $DS = 1$ if the observations belong to Singapore
$= 0$ if otherwise

$DM = 1$ if the observations belong to Malaysia
$= 0$ if otherwise

On comparison between pooled regression and FEM, which model is better to explain the GDP growth in these three countries? Show the necessary calculations by using F test at $\alpha = 5\%$. (10 marks)

(Total: 20 marks)

QUESTION 4

(a) Given the data on log SP (share price), you want to fit a suitable ARIMA model to these data. Outline the steps involved in carrying out this task. (8 marks)

(b) "The number of lags to be introduced in a VAR model can be a subjective question." Comment on this statement. (4 marks)

(Total: 12 marks)

End of Paper

Formula

$$F = \frac{(R^2_{UR} - R^2_R)/m}{(1 - R^2_{UR})/(n-k)};$$

n = number of observations; m = number of linear restrictions; k = number of parameters in the unrestricted (UR) regression

Statistical Tables

t -Table

two tails	0.2	0.1	0.05	0.02	0.01
One tail	0.1	0.05	0.025	0.01	0.005
df					
10	1.37	1.81	2.23	2.76	3.17
20	1.33	1.72	2.09	2.53	2.84
30	1.31	1.70	2.04	2.46	2.75
40	1.30	1.68	2.02	2.42	2.70
50	1.30	1.68	2.01	2.40	2.68
60	1.30	1.67	2.00	2.39	2.66
75	1.29	1.67	1.99	2.38	2.64
100	1.29	1.66	1.98	2.36	2.63
120	1.29	1.66	1.98	2.36	2.62

TABLE D.7 1% and 5% Critical Dickey–Fuller t ($= \tau$) and F Values for Unit Root Tests

Sample	t_{nc}*		t_c*		t_{ct}*		$F^\dagger$		$F^\ddagger$	
Size	1%	5%	1%	5%	1%	5%	1%	5%	1%	5%
25	−2.66	−1.95	−3.75	−3.00	−4.38	−3.60	10.61	7.24	8.21	5.68
50	−2.62	−1.95	−3.58	−2.93	−4.15	−3.50	9.31	6.73	7.02	5.13
100	−2.60	−1.95	−3.51	−2.89	−4.04	−3.45	8.73	6.49	6.50	4.88
250	−2.58	−1.95	−3.46	−2.88	−3.99	−3.43	8.43	6.34	6.22	4.75
500	−2.58	−1.95	−3.44	−2.87	−3.98	−3.42	8.34	6.30	6.15	4.71
∞	−2.58	−1.95	−3.43	−2.86	−3.96	−3.41	8.27	6.25	6.09	4.68

*Subscripts nc, c, and ct denote, respectively, that there is no constant, a constant, and a constant and trend term in the regression Eq. (21.9.5).

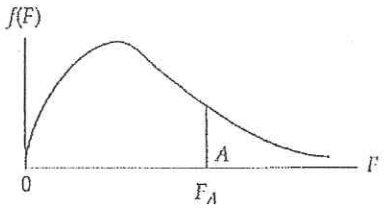
†The critical F values are for the joint hypothesis that the constant and δ terms in Eq. (21.9.5) are simultaneously equal to zero.

‡The critical F values are for the joint hypothesis that the constant, trend, and δ terms in Eq. (21.9.5) are simultaneously equal to zero.

Source: Adapted from W. A. Fuller, *Introduction to Statistical Time Series*, John Wiley & Sons, New York, 1976, p. 373 (for the τ test), and D. A. Dickey and W. A. Fuller, "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root," *Econometrica*, vol. 49, 1981, p. 1063.

F-Table (Partial)

Critical Values of F, $A = .05$



ν_2 \ ν_1	NUMERATOR DEGREES OF FREEDOM								
DENOMINATOR DEGREES OF FREEDOM	1	2	3	4	5	6	7	8	9
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88

SOURCE: From M. Merrington and C. M. Thompson, "Tables of Percentage Points of the Inverted Beta (F)-Distribution," *Biometrika* 33 (1943): 73–88. Reproduced by permission of the Biometrika Trustees.